This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

HDI
HW 2M35 4

Digitized by Google

KE 32941

Harvard College Library

~~FROM~~

Gratis,

17 Dec. 1888.

Digitized by Google

HARVARD COLLEGE
DEC 17 1888
LIBRARY

Gratis.

MISSOURI RAINFALL.

— BY —

FRANCIS E. NIPHER,

PROFESSOR IN WASHINGTON UNIVERSITY. DIRECTOR MISSOURI WEATHER SERVICE.

SAINT LOUIS, MO.
1888.

Digitized by Google

Digitized by Google

HARVARD COLLEGE
DEC 17 1888
LIBRARY.

MISSOURI RAINFALL.

— BY —

FRANCIS E. NIPHER,

PROFESSOR IN WASHINGTON UNIVERSITY. DIRECTOR MISSOURI WEATHER SERVICE.

SAINT LOUIS, MO.
1888.

Digitized by Google

KE 32941
KE 32149
Phf 6659.88.3

HARVARD UNIVERSITY LIBRARY

THE MISSOURI WEATHER SERVICE.

Shall it be Sustained as a State Service?

BY FRANCIS E. NIPHER.

HISTORY OF THE ORGANIZATION.

In November, 1877, the writer entered into correspondence with gentlemen in various parts of the state, which resulted in the organization of a volunteer weather service in Missouri. The number of observers at the outset was about forty, and the observations were begun Dec. 1, 1877.

The observers were nearly all furnished with tested rain gauges, for which they paid the cost price; many of them also secured thermometers, which however, have never been compared with any standard, nor were any instructions issued regarding the proper exposure of these thermometers.

The object of the service was, primarily, to investigate the rainfall of the state, and the work has been largely confined to that subject.

The scope of the subject was thus limited by reason of the fact that the director could not afford to give the time and means required to carry on a more extended work.

Nevertheless, most of the observers have made observations upon temperature, some using ordinary thermometers, and others providing themselves with Green's or other good instruments.

Digitized by Google

At the time of organizing the service, a state weather service had already been organized in Iowa, in October, 1875, by Dr. Gustavus Hinrichs, to whom belongs the honor of being the pioneer in State Weather Service work.

In those days the Signal Service was unfriendly to State Service work. Many observers in Iowa and Missouri remember the circular letter of the Chief Signal Officer, Gen. Meyer, dated Nov. 1, 1877, warning them that "no circulars or circular letters relating to the taking of observations, the concentration of reports, or in other ways connected, or seemingly connected with the duties of this office, are authorized by it, unless such circulars are dated from the office of the Chief Signal Officer at Washington, D. C., and are authenticated by the signature of the Chief Signal Officer or by that of an officer acting under his special order in each case, and so shown upon the circular."

The Weather Services of Iowa and Missouri continued to grow notwithstanding, and that of Iowa was made a State Service by the Seventeenth General Assembly, in 1877.

When Gen. Hazen became Chief Signal Officer in November, 1880, a more liberal, not to say more enlightened policy was soon manifest, and the great value of State Weather Services was fully recognized. The Signal service now coöperates most heartily with them, Since that time many states have followed the example of Iowa and Missouri, namely: Alabama, Arkansas, Illinois, Indiana, Kansas, Louisiana, Michigan, Minnesota, Mississippi, Nebraska, Nevada, New England, New York, New Jersey, North Caralina, Ohio, Oregon, Pennsylvania, South Carolina, Tennessee and Texas. Several of these states have made adequate appropriations for carrying on this work; among these, Iowa and Ohio have done most.

The present Chief Signal Officer, Gen'l Greeley, has done much to encourage the establishing of these State Services, although he states in a personal letter that he does not feel that the National Service has any function to perform in connection with them save to give such slight aid as may be possible, and to give the benefit of its advice when so desired.

Digitized by Google

He adds that in his opinion the cost of making known the climate of a State should fall upon the people of that State, and when, as in the case of Missouri, it has a climate suited to the production of all the great staples of the country, there is no reason why the State should hesitate to make this known.

VALUE OF STATE WEATHER SERVICES.

To show how valuable the information collected by a state service may be, the following is cited:

In Iowa, horticulturalists have found much trouble to grow apple trees by reason of the severe winters. A prominent horticulturalist imported varities of Russian apples, introducing them with the statement that the climate from which they came was similar to that of Iowa. They were widely planted, and there was a very general neglect of native varieties which had in part succeeded. Dr. Hinrichs made an extensive study of Russian climate, ahd showed conclusively that that couutry had no climate which in any way resembled that of Iowa. It is generally agreed by those interested, that this one paper of Dr. Hinrichs, comparing the climates of Russia and Iowa, was worth in cash to the state more than the service has cost in ten years. It showed the danger of depending on Russian apple trees.

At the present time, some eastern capitalists are investigating the climate of Missouri, with a view of investing a million of dollars in a new industry. If the Missouri Weather Service could not give the required information, there is no reason to think that these men would even contemplate the investment of their capital in our state.

RELATION OF THE STATE SERVICE TO THE NATIONAL SERVICE.

The state weather service bears the same relation to the national service, that the state government bears to the national government.

There are many large storms, of great severity, which damage shipping and endanger life. The Signal Service has done a

Digitized by Google

great work in giving warning of these storms. Shippers and dealers in provisions and fruits find the cold wave warnings of the greatest value. In all large cities the approach of a "warm spell" is known through the Signal Service predictions, and thousands of tons of meats are hurried to cold storage warehouses, and the opportunity to ship other provisions which must be kept from freezing is anticipated and made available, It is not saying too much to say that it would be impossible to carry on the shipping business of the country, as it is now carried on, without the aid of the national weather service.

But each state has its own peculiar industries, advantages and interests. It should provide for a thorough study of its own climate, and should distribute published reports for the benefit of those who may desire such knowledge.

There is another field which peculiarly belongs to the state weather service. The weather, which is of greatest importance to the farmer, is the weather of harvest. During that time storms are usually very local. They may cover a few counties only, and inflict immense damage. People living in the city can learn from the Sigual Service that there will be "local rains in Missouri," but nobody knows where in Missouri they are going to locate, and even this information reaches the farmer only after the rain is over, if at all.

The local peculiarities of these storms require study in each state. Very much has been done in this direction in Iowa and by the New England Meterological Society. Such work should be at once begun in our state. In three or four years we should be familiar with the behavior of these storms, and this knowledge could be given to all.

In 1893 the telephone will become public property, and it will then be possible for county telephone services to be established, putting each farm in communication with a county seat. Telephone service can be rendered for a sum which will be utterly insignificant when compared with the advantages which it will bring. Farmers can then keep informed of the markets, can sell their produce before leaving their homes, and will be

Digitized by Google

able to save much time which they now waste during the busy season of harvest. This is all so apparent that it is needless to discuss it further. In addition, there will grow up a system of harvest storm warnings. It will be very easy for any county telephone system to give its subscribers a general warning of an approaching thunder storm, and to transmit that information to such other counties as may be in danger. The exact details of this scheme may be left to the director of a state weather service to work out. It seems certain that this can and will be done, and there is no more reason that this should be done by the National weather service, than that the Congress of the United States should concern itself with the building of a wagon bridge across the Gasconade River.

PAST WORK OF THE MISSOURI WEATHER SERVICE.

The rain charts which accompany this paper show the average distribution of rain for each month and season, and for the year. They embody our labors in this direction from Dec. 1877 to Dec. 1887. In addition, the Director has made a magnetic survey of the state, which for five years, required all of his time during the summer, and a large part of the leisure time of the remaining portion of the year. The time and money expended in this and in general weather service work, if paid for as they are valued by others who employ those services, would be not less than fifteen thousand dollars. Personal friends have also rendered additional aid in carrying the financial burdens, and the cheerful support which the observers have rendered, has been a source of pleasure from the beginning.

But the time has now come when it would seem that the state should be invited to assume the, to it, slight burden of maintaining the weather service. A sum of two thousand dollars per annum with additional provision for printing the reports, will suffice, until the time comes to develop the system of harvest warnings herein mentioned. This sum will provide a small compensation to the Director, pay current petty expenses, and furnish each year standard instruments to a few tried observers, as the quality of their work may show that they are ready to render suitable service.

Digitized by Google

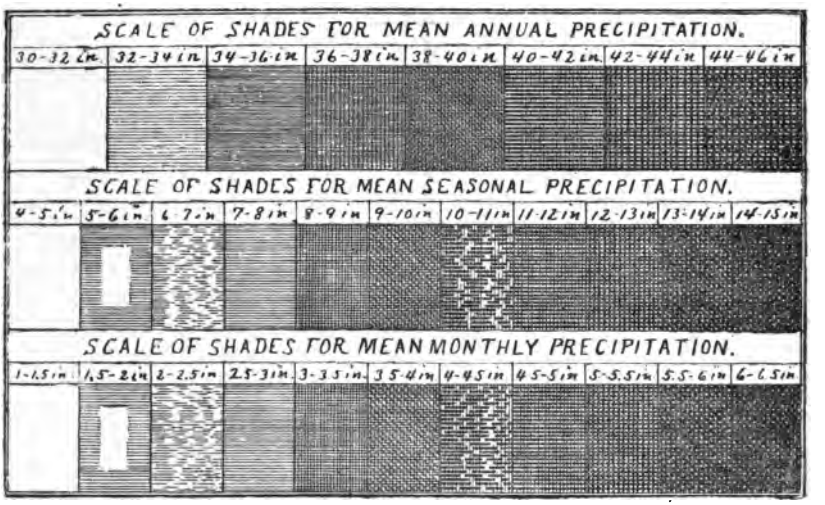
EXPLANATIONS OF THE PLATES.

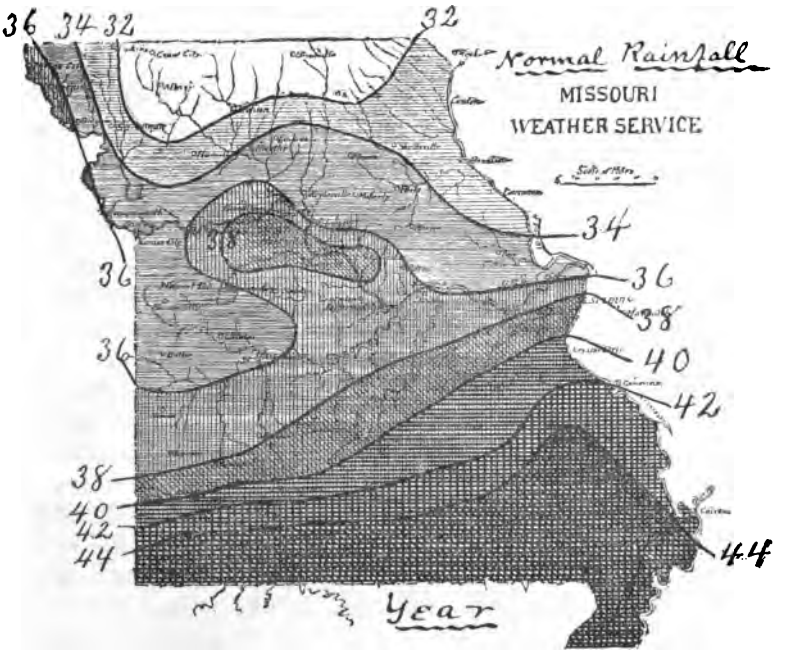
The monthly rain maps give in each case the average rainfall for that month for ten years ending December 31st, 1887.

The rainfall is given in inches and tenths. On some of the maps the decimal point was not reproduced in the copper plate.

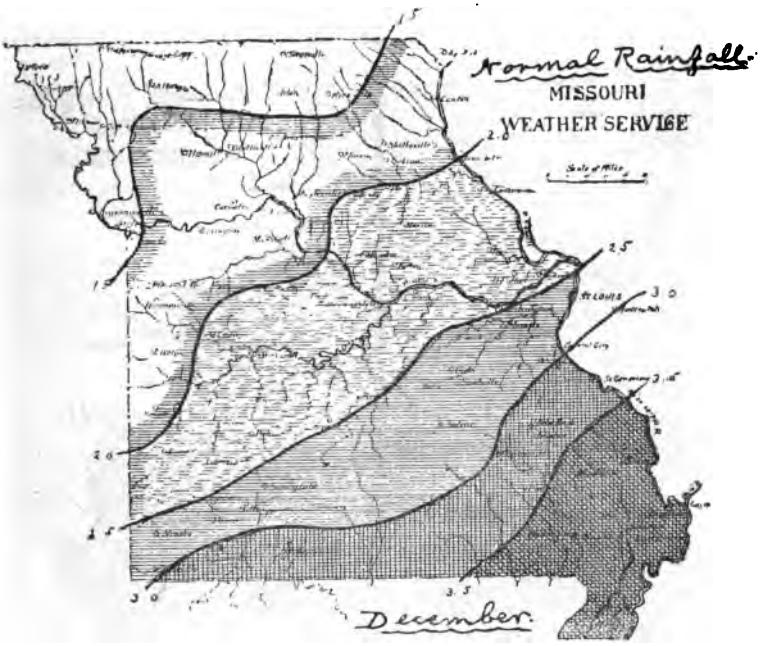
Average monthly values which have been approximated by means of monthly maps are indicated by an asterisk.

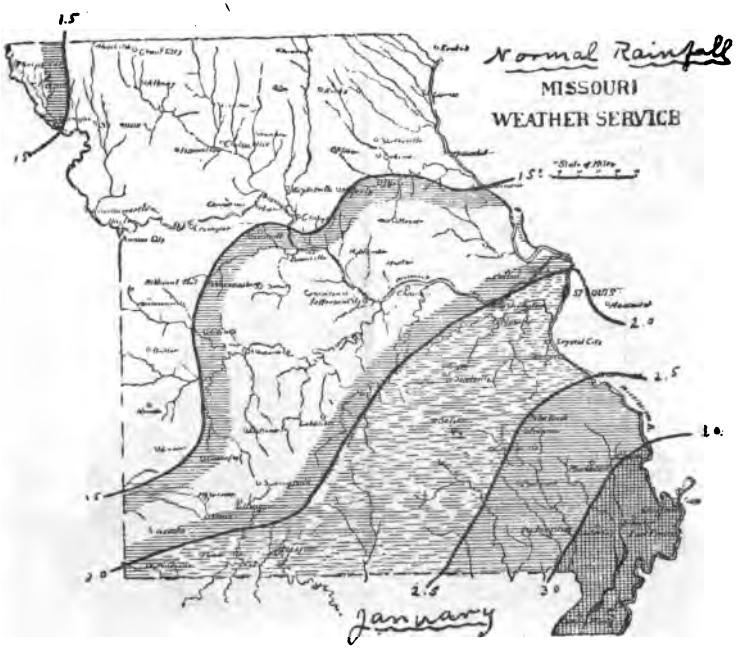
Digitized by Google



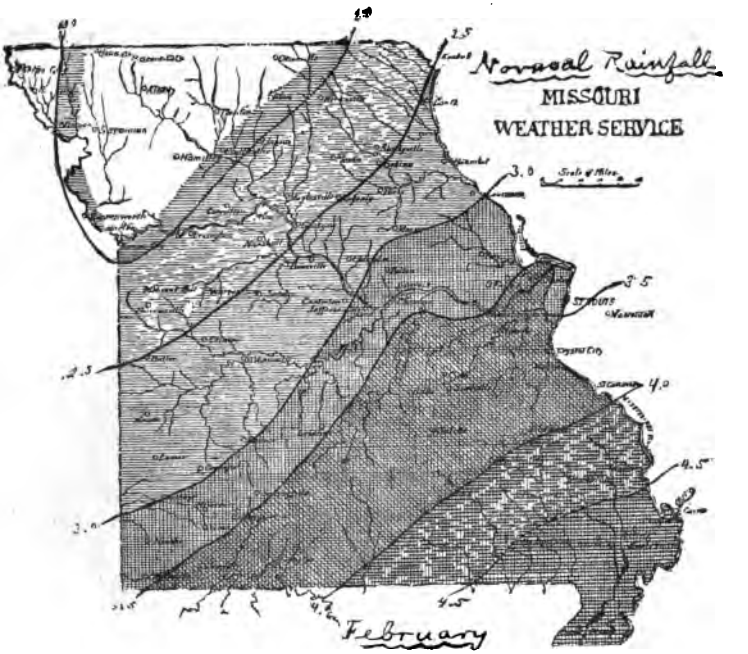


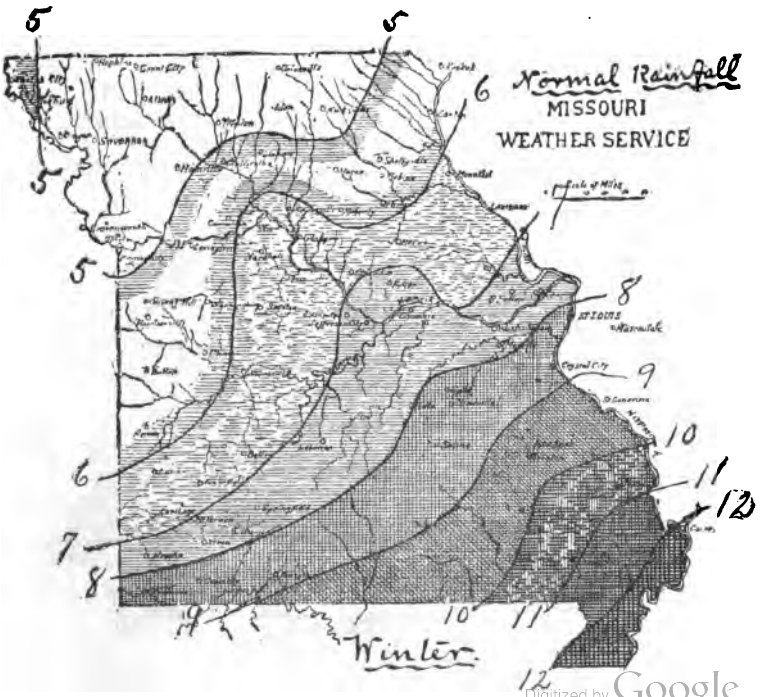
Digitized by Google



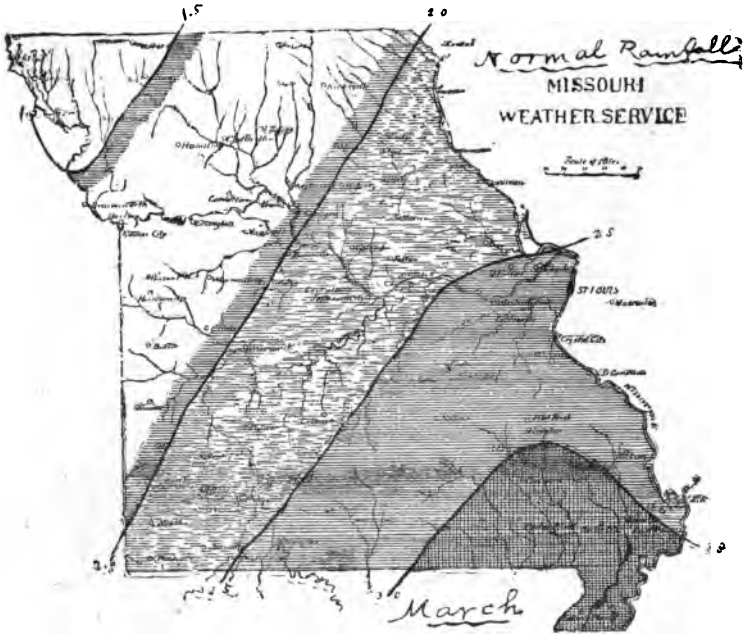


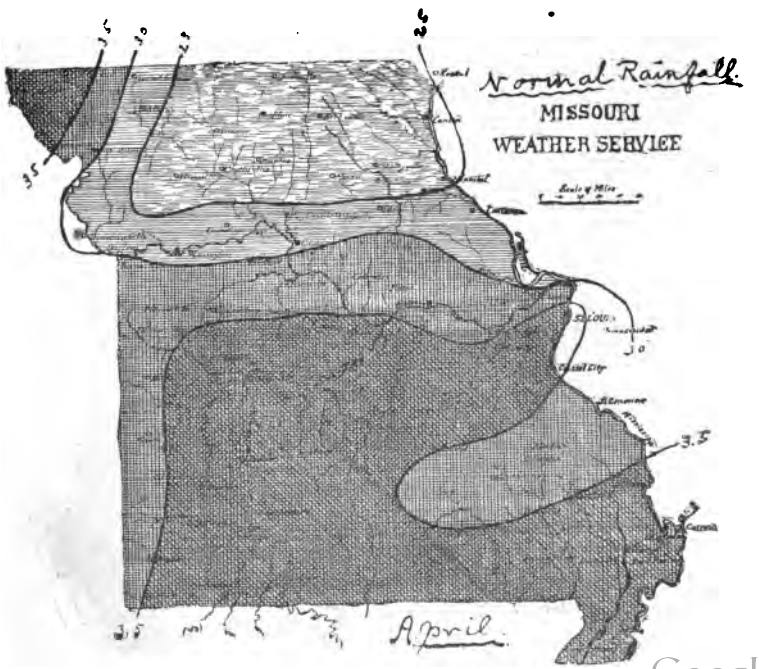
Digitized by Google



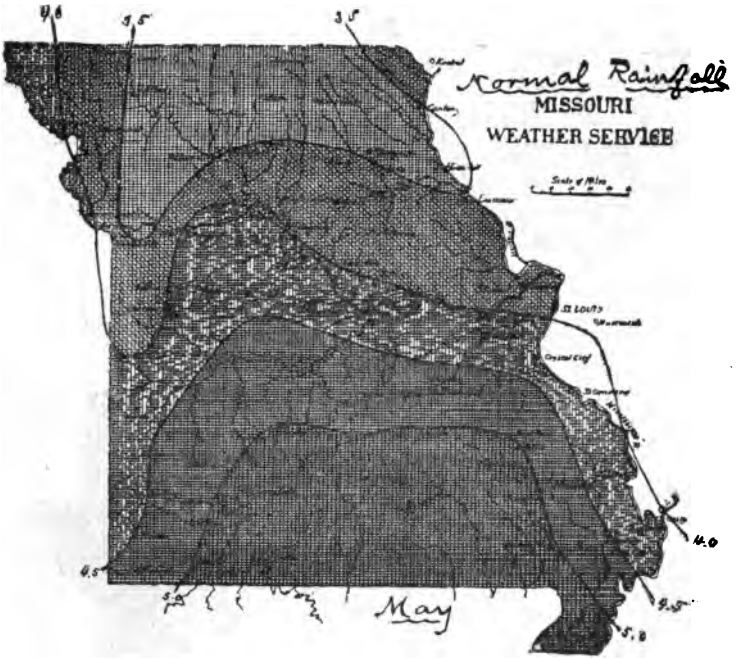


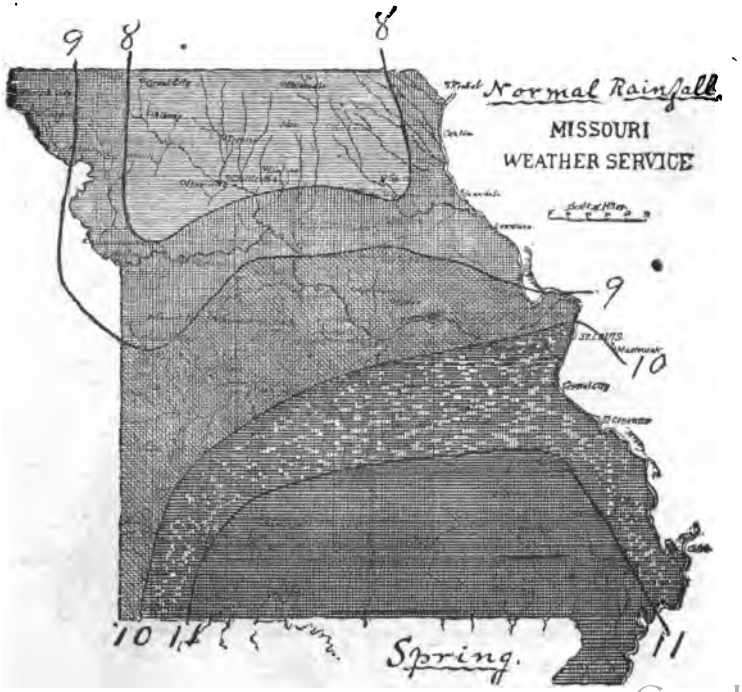
Digitized by Google



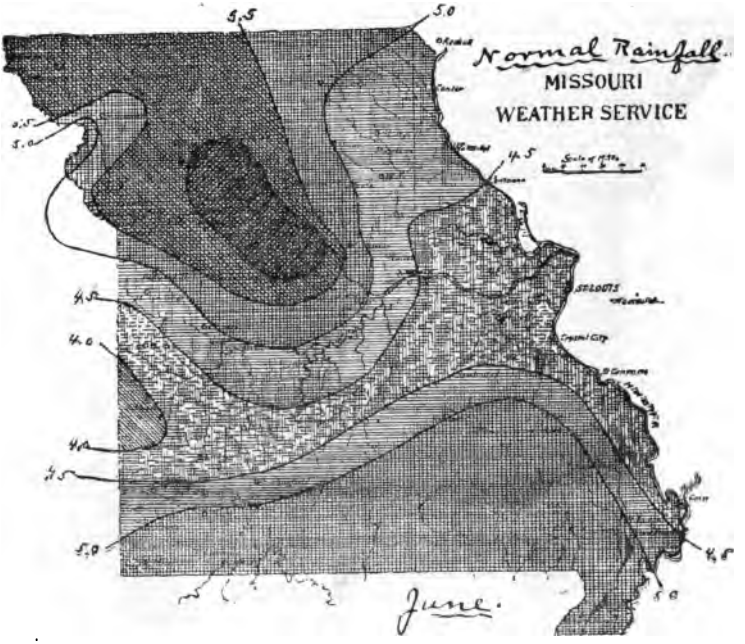


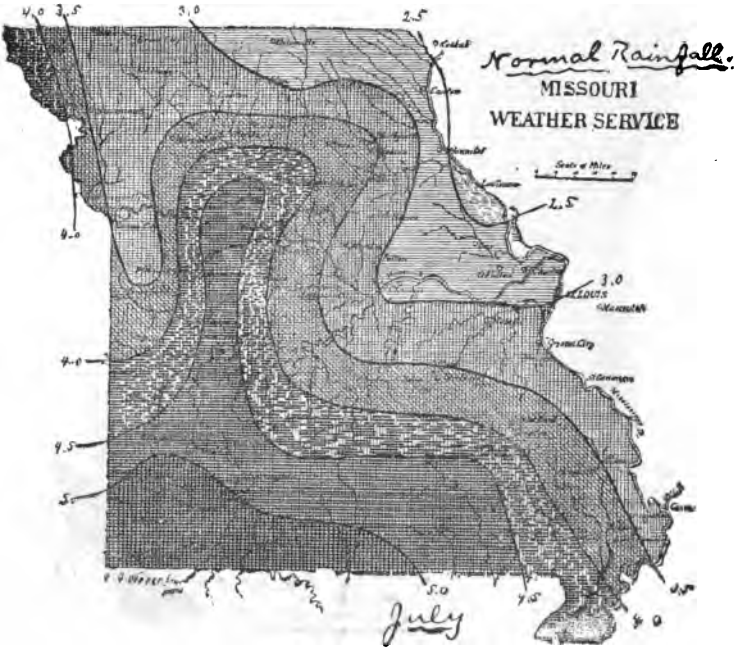
Digitized by Google





Digitized by Google

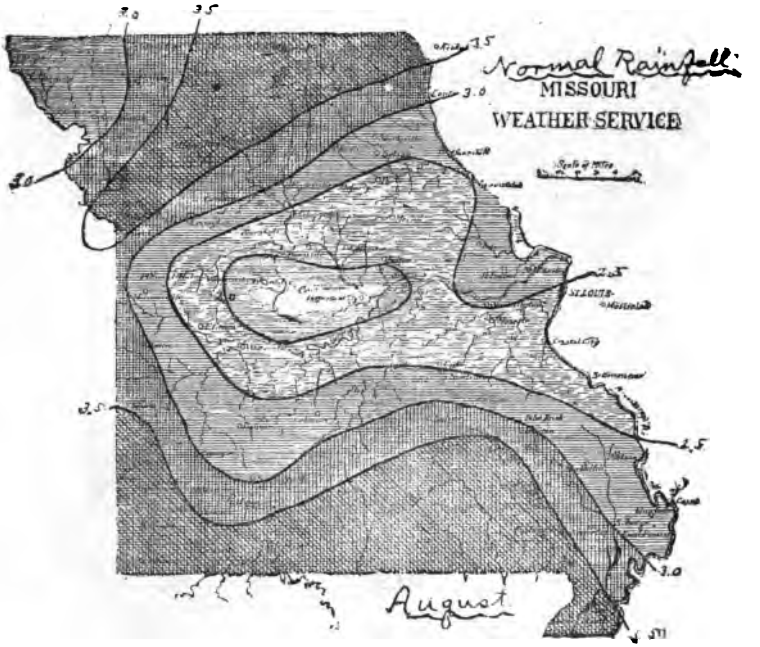


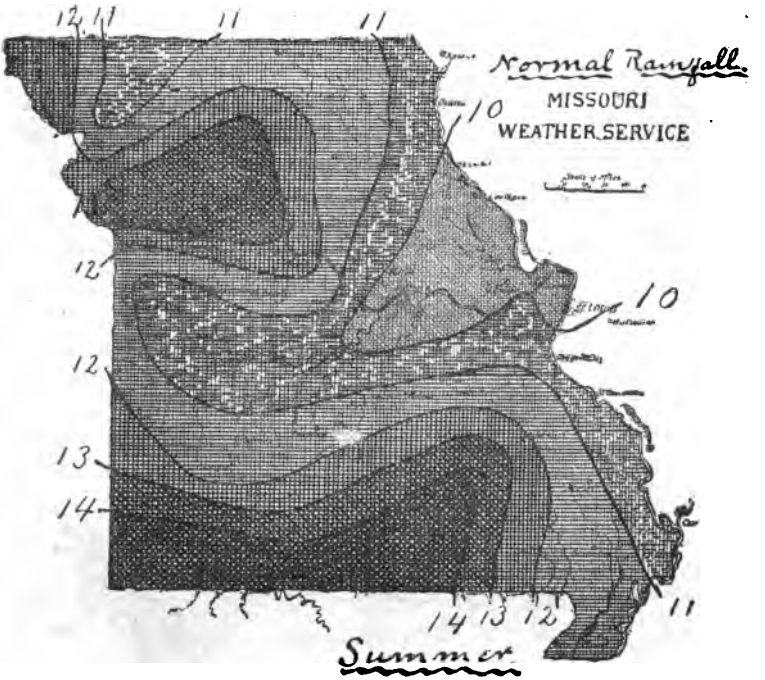


Digitized by Google

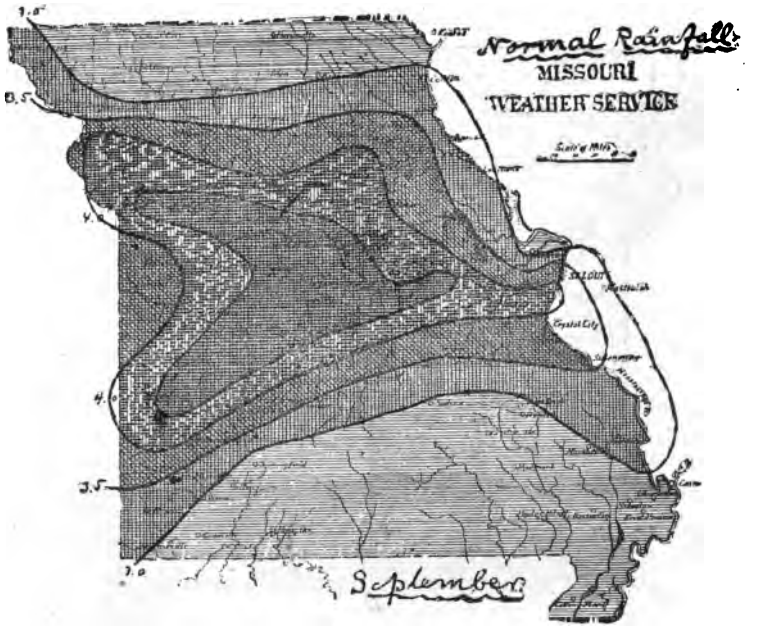
Digitized by Google

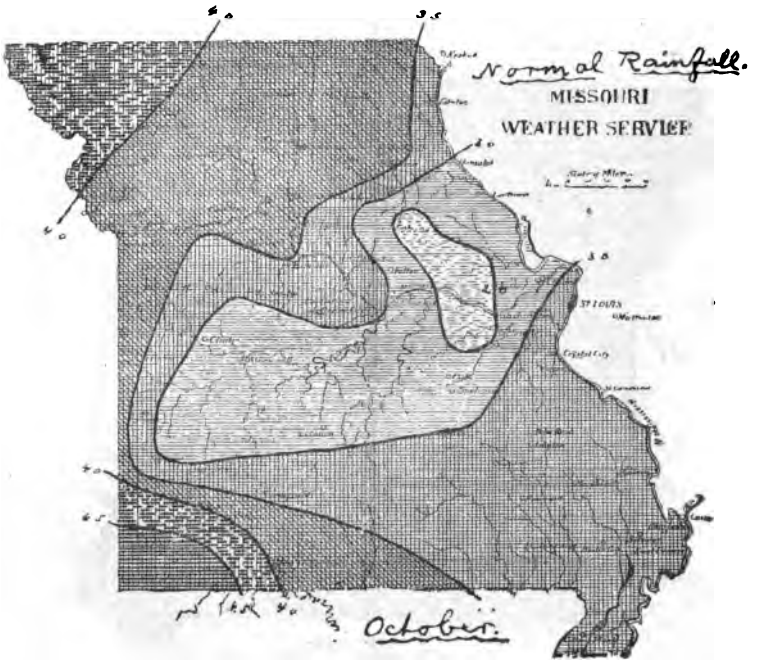
Digitized by Google



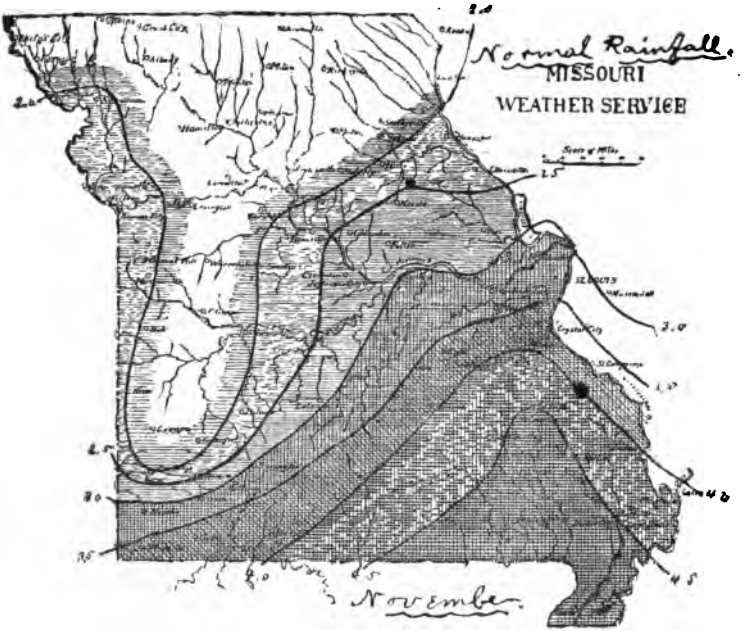


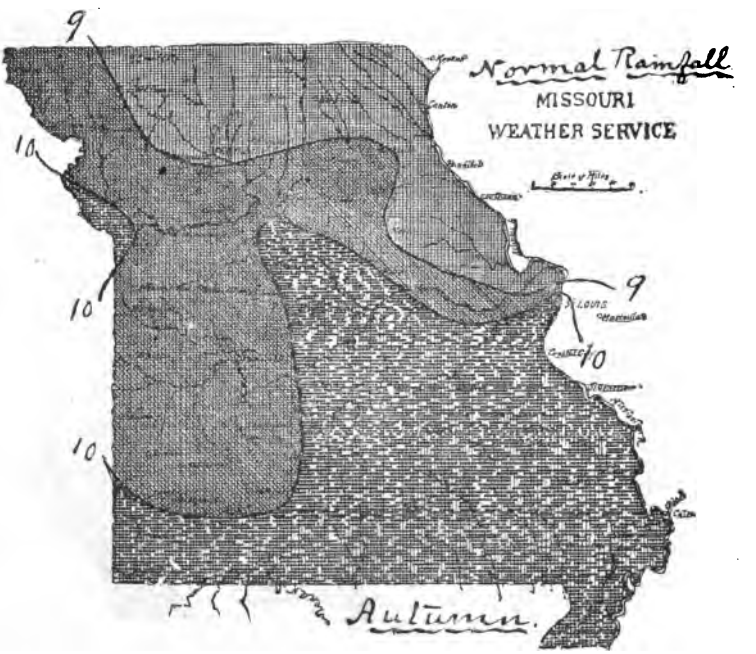
Digitized by Google





Digitized by Google





Digitized by Google

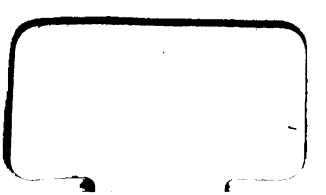
Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

HW 2M35 4



Digitized by Google